Notice of Allowability	Application No.	Applicant(s)	
	10/666,189	HAMMAN, BRIAN A.	
	Examiner	Art Unit	
	Anatoly Vortman	2835	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *RCE filed on 8/8/05 and amendment filed on 8/29/05*.

2. ☒ The allowed claim(s) is/are *100-134 (renumbered 1-35, respectively)*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *9/30/05*.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

A. Vortman

ANATOLY VORTMAN
PRIMARY EXAMINER

EXAMINER'S AMENDMENT

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application on 08/29/05 after final rejection, which was mailed on 05/26/05. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submissions filed on 07/11/05 and 08/29/05 have been entered.

Amendment

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with **Mr. Arthur W. Fisher, Reg. No. 27,549 on 09/27/05.**

The application has been amended as follows:

All pending claims of record, i.e. claims 52-73, 75-90, and 92-99 have been cancelled.

New claims 100-134 have been added:

- - 100. A liquid cooling system for cooling heat-generating components in an electronic system having a self-contained heat exchange unit installable as a single unit within the electronic system and comprising:

an input cavity for receiving heated liquid and distributing the heated liquid to a dissipater;

a dissipater for receiving the heated liquid and cooling the liquid;

an output cavity for receiving the cooled liquid from the dissipater and transporting the cooled liquid to the system;

wherein the input cavity, the dissipater and the output cavity are disposed to form the self-contained heat exchange unit;

one or more heat transfer units coupled to the heat generating components for receiving cooled liquid from the heat exchange unit and generating heated liquid for transportation to the heat exchange unit; and

means for transporting cooled liquid from the heat exchange unit to the heat transfer units and for transporting heated liquid from the heat transfer units to the heat exchange unit.

101. A liquid cooling system as set forth in claim 100 wherein the heat transfer units and the heat exchange unit are deployed in a single unit installable as a single unit within the electronic system.

102. A liquid cooling system as set forth in claim 100 wherein the means for transporting includes a pump disposed in the heat exchange unit.

103. A liquid cooling system as set forth in claim 100 wherein the dissipater includes one or more liquid paths for transporting the liquid through the dissipater.

104. A liquid cooling system as set forth in claim 103 wherein said liquid paths include means for creating non-laminar flow of the liquid to enhance the transfer of heat from the liquid to the dissipater.

105. A liquid cooling system as set forth in claim 102 wherein the pump is disposed in the output cavity.

106. A liquid cooling system as set forth in claim 102, wherein the pump is a self-priming pump.

107. A liquid cooling system as set forth in claim 105 wherein the pump is disposed at the lowest possible point in the heat exchange unit.

108. A liquid cooling system as set forth in claim 102 wherein the pump includes an impeller, the heat exchange unit further comprising:

a motor coupled to the heat exchange unit; and

a shaft coupling the motor to the impeller means, the motor operating the impeller through the shaft.

109. A liquid cooling system as set forth in claim 108 wherein the motor is disposed on top of the heat exchange unit and away from possible contact with the liquid.

110. A liquid cooling system as set forth in claim 108 wherein the shaft is disposed through the liquid in the dissipater.

111. A liquid cooling system as set forth in claim 110 wherein no seal is necessary for the impeller.

112. A liquid cooling system as set forth in claim 100 wherein the heat exchange unit further comprises one or more fans disposed to direct air through the heat exchange unit and out of the electronic system housing.

113. The liquid cooling system as set forth in claim 112 wherein the dissipater includes fins for dissipating heat from the liquid and disposed so as to create a non-laminar flow of the air from the fans.

114. A liquid cooling system having a self-contained heat exchanger unit installable as a single unit within a system with one or more heat-generating components and having one or more heat transfer units, the liquid cooling system comprising:

an input cavity for receiving heated liquid and distributing the heated liquid to a dissipater;

a dissipater for receiving the heated liquid and cooling the liquid;

an output cavity for receiving the cooled liquid from the dissipater and transporting the cooled liquid to the system;

wherein the input cavity, the dissipater and the output cavity are disposed to form the self-contained heat exchange unit;

a heat transfer unit housing for coupling to heat-generating components;

an inlet to the heat transfer unit housing;

an outlet from the heat transfer unit housing positioned above the inlet;

means for transporting liquid coupled to the inlet and the outlet; and

wherein cooled liquid from the self-contained heat exchange unit enters the heat transfer unit housing at the inlet and heated liquid exits the heat transfer unit housing at the outlet.

115. The liquid cooling system in claim 114 for cooling heat generating components in an electronic system.

116. The liquid cooling system of claim 115 wherein the heat transfer units further comprise:

a contact side coupled to the housing for forming a cavity for conveying liquid and thermally coupled to one or more heat-generating components, the contact side capable of transporting heat from the heat generating components to the liquid thereby producing heated liquid which rises in the cavity.

117. The liquid cooling system in claim 100 wherein the input cavity is positioned above the dissipater and the output cavity is positioned below the dissipater.

118. A liquid cooling system as set forth in claim 53 wherein the liquid coolant is a propylene glycol base.

119. A method of cooling heat generating components in an electronic system having a self-contained heat exchange unit installable as a single unit within the electronic system, the self-contained heat exchange unit including an input cavity for receiving heated liquid and distributing the heated liquid to a dissipater which cools the heated liquid and an output cavity for receiving the cooled liquid from the dissipater and transporting the cooled liquid to the electronic system, and wherein the input cavity, the dissipater and the output cavity are disposed to form the self-contained heat exchange unit, and further having one or more heat transfer units coupled to the heat generating components for receiving cooled liquid from the heat exchange

unit and generating heated liquid for transportation to the heat exchange unit and means for transporting cooled liquid from the heat exchange unit to the heat transfer units and for transporting heated liquid from the heat transfer units to the heat exchange unit; the method comprising:

a step for receiving heated liquid from the heat transfer units at the self-contained heat exchange unit;

a step for cooling the liquid within the self-contained heat exchange unit for transportation to the heat transfer units;

a step for transporting the cooled liquid to the heat transfer units by said means for transporting;

a step for receiving cooled liquid from the self-contained heat exchange unit at the heat transfer units; and

a step for heating the liquid within the heat transfer units by transferring heat from the heat-generating components to the liquid for transportation to the self-contained heat exchange unit.

120. A method of cooling as set forth in claim 119, the method further comprising the steps of:

receiving heated liquid at an input cavity of the self-contained heat exchange unit and distributing the heated liquid to a dissipater in the self-contained heat exchange unit;

cooling the liquid in the dissipater; and

receiving the cooled liquid from the dissipater at an output cavity in the self-contained heat exchange unit for directing the cooled liquid to the system.

121. The method of claim 119 further comprising the step of directing air flow through the heat exchange unit and out of the electronic system to maintain cooler temperatures inside the electronic system housing.

122. A method of cooling as set forth in claim 119, comprising the steps of:

performing convective circulation in one or more of the heat transfer units by positioning an outlet for heated liquid from the heat transfer units above an inlet of the heat transfer units which receives cooled liquid, the liquid rising in response to the transfer of heat from the heat generating components to the liquid in the heat transfer unit.

123. A method of cooling as set forth in claim 119 comprising the additional steps of performing convective circulation by:

positioning the input cavity above the dissipater; and

positioning the output cavity below the dissipater.

124. A method of cooling as set forth in claim 119, the method further comprising the steps of:

performing forced circulation of the liquid in the liquid cooling system by a pump; and

performing convective circulation of the liquid in the liquid cooling system by disposing inlets and outlets for cooler liquid below inlets and outlets for heated liquid.

125. The method in claim 124 further including the step of dissipating heat generated by the heat generating components in response to the forced circulation and convective circulation.

126. The method in claim 124 wherein the heat generating components are cooled after power is shut down in the system.

127. The method in claim 124 for saving power consumed in the system.

128. A method of cooling as set forth in claim 119 further comprising the step of using propylene glycol as the base for the liquid coolant.

129. A motherboard further comprising the liquid cooling system of any one of those in claims 100, 102 or 114.

130. A computer further comprising the liquid cooling system of any one of those in claims 100, 102 or 114.

131. A telecommunications system further comprising the liquid cooling system of any one of those in claims 100, 102 or 114.

132. A cellular telephone further comprising the liquid cooling system of any one of those in claims 100, 102 or 114.

133. A device including a processor further comprising the liquid cooling system of any one of those in claims 100, 102 or 114.

134. An optical device further comprising the liquid cooling system of any one of those in claims 100, 102 or 114. --

3. The following is an examiner's statement of reasons for allowance:

The allowability resides in the overall structure of the device as recited in independent apparatus claims 100 and 114 and in the overall method of cooling as recited in independent method claim 119, and at least in part, because claim 100 recites: "means for transporting

cooling liquid", claim 114 recites: "means for transporting liquid coupled to the inlet and outlet", and claim 119 recites: "a step for transporting the cooled liquid to the heat transfer units by said means for transporting".

All of the aforementioned limitations in combination with all remaining limitations of claims 100, 114, and 119, respectively, are believed to render the claims and all claims dependent therefrom patentable over the art of record.

The aforementioned limitations have invoked consideration under 35 USC 112, paragraph six, because they are "means plus function" or "step plus function" limitations. No significant structure pertained to the "means for transporting" has been recited in the claims. The supporting structure for the "means for transporting" (i.e. a pump) has been recited in the specification as follows:

"[T]he motor 114 is connected through a shaft 302 to an impeller 316, disposed in an impeller case 314...an impeller housing 314, an impeller casing input 320, and an impeller exhaust 318 are positioned within the output cavity 312. The impeller exhaust 318 is connected to the output conduit 118B." (p. 23, paragraph [0066]";

"[A] shaft 302 runs through the input cavity 300, through the heat dissipater 310 (i.e., through a liquid tube 308), to the output cavity 312." (p. 24, paragraph [0069]);

"The motor 114 is positioned on one end of the shaft 302 and an impeller 316 is positioned on an oppositely disposed end of the shaft 302. In one embodiment, the motor 114 may be implemented with a brushless direct current motor; however, other types of motors, such as AC induction, AC, or DC servo-motors, may be used. Further, different types of motors that

are capable of operating a pump are contemplated and are within the scope of the present invention." (p. 24, paragraph [0071];

"The impeller 316 is positioned within an impeller housing 314. In one embodiment, the impeller 316 and the impeller housing 314 are positioned in an output cavity 312." (p. 23, 25, paragraph [0072]);

"The shaft 302 is disposed within a central liquid tube 308." (p. 26, paragraph [0076]);

"[T]he pump is deployed in the output cavity 312" (p. 27, paragraph [0081]);

"The impeller 316 includes a base plate 600 and blade members 602. The shaft 302 connects to the base plate 600 and the blade members 602. The base plate 600 and the blade members 602 may be connected to the shaft 302 with adhesives, by press fitting, machining, etc. In one embodiment, base plate 600 and blade member 602 are held in place by containment units 604 and 606. As a result, as the shaft 302 performs a circular revolution, both the base plate 600 and shaft 302 move through a circular revolution." (p. 27, paragraph [0080]); and,

"Blade members 602 are radially curved from the shaft 302 outward through an arc. Impeller 316 may also include one or more apertures 608, formed through base plate 600 and through blade members 602. In one embodiment, apertures 608 may be slanted or oriented in a position relative to blade members 602 and base plate 600 to enhance liquid movement induced by impeller 316. It should also be appreciated that blade members 602 may be implemented with a variety of curved blades, straight blades, etc. In one embodiment of the present invention, a pump used to circulate liquid in the liquid cooling system is implemented with an impeller, such as impeller 316... In addition, in one embodiment (i.e., see Fig. 3), the pump is deployed in the output cavity 312" (p. 28, paragraph [0081]).

The pump structure as recited above is depicted on Fig. 3 and 6 of the instant application.

None of the references of record teaches the pump structure as recited above. None of the references of record either taken alone or in combination is believed to render the present invention unpatentable as claimed.

Conclusion

4. Any comments considered necessary by Applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anatoly Vortman whose telephone number is 571-272-2047. The examiner can normally be reached on Monday-Friday, between 10:00 am and 6:30 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ms. Lynn Feild can be reached on 571-272-2092. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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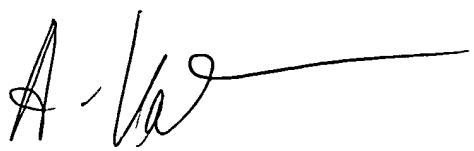

Anatoly Vortman
Primary Examiner
Art Unit 2835